



PREMIER AVIATION ENGINEERING REPORT NO. E94-309

STATIC TEST OF A BELLY-MOUNTED FLIR ON  
BELL 206 SERIES HELICOPTERS

PART I: TEST PLAN

FAA PROJECT NO. SW-170-909

AMENDMENT TO STC SH3763SW

BY:



Martin R. Crane

STATIC TEST OF A BELLY MOUNTED FLIR ON BELL  
MODEL 206 SERIES HELICOPTERS

SIZE

A

SCALE: N/A

CODE IDENT NO.

OSUV8

REV: -

DWG NO.

E94-309

SHEET: 2 of 11

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## INTRODUCTION

This report documents a static test of the installation of a FLIR belly-mount configuration. This installation is part of an interior for Bell Models 206 A, B, L, L-1, L-3, and L-4 helicopters. The installation is installed per Premier Aviation Master Drawing List, 206-AA-01.

This test is to fulfill the requirements towards a modification of STC SH3763SW. The test will show compliance with CAR 6, paragraphs 6.200, 6.201, 6.202 6.210, 6.211, 6.212, and 6.260. Loads will be based on the emergency landing provisions of CAR 6.260, the limit maneuver loads of CAR 6.212, and the drag forces exerted on the externally mounted FLIR Imager.

There are two actions involved with modification of this STC. First, the Bell Model 206 L-4 is being added to the STC. Secondly, an alternate location for the FLIR Imager is proposed. The FLIR Imager mount is being moved approximately 12 inches to the right of centerline forward of the landing gear cross tubes.

Two prior locations of the FLIR Imager mount have been approved under this STC. One location is between the skid gear on the centerline. The second location is forward of the cross tubes on the centerline. The two prior locations are not affected by the addition of the L-4 to the STC.

Prior to testing, a MIDO conformity will be conducted to Premier Aviation MDL 206-AA-01. The testing will be conducted at the Premier Aviation, Inc. facility at the Grand Prairie municipal airport. The test will be conducted by Premier Aviation personnel and will be witnessed by an FAA structural engineer or a designated engineering representative.

The report will be updated with a PART II: TEST RESULTS, upon successful completion of the test.

In addition to the structural substantiation test, a measurement of the ground clearance of the FLIR Imager will be performed. A minimum clearance of 10.8 inches is required as defined in the STC'd drawings for this installation.

The results of the static test of the FLIR Imager will be added as Part II of this report.

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## TEST LOADS

The loads to be applied are described below. In order to preclude possible damage to the FLIR Imager, it will be removed from the mount and will be replaced with a test fixture that accurately simulates the loads applied to the FLIR mounting provisions. All test loads will be applied to the test fixture at the c.g. of the FLIR Imager. The c.g. of the FLIR Imager is 8.6 inches below the dove-tail mount.

The weight of the FLIR Series 2000 of Imagers that could be installed under this STC varies. The basic FLIR 2000 A/B Imager weighs 49.5 pounds. The FLIR 2000 E/F Imager that is being installed on the aircraft being used for testing purposes weighs 51.5 pounds. To encompass any further increase in weight, a FLIR weight of 60 pounds will be assumed for testing purposes. The physical dimensions of the FLIR Imagers in the 2000 Series does not vary, only the internal components vary.

### **EMERGENCY LANDING CONDITIONS CAR 6.260**

The emergency landing provisions of CAR 6.260 are defined as follows:

#### **Forward Load of 4 g's**

Forward = 4 g's x 60 pounds = 240 pounds.

The forward load will be applied with a spring scale. If the range of the spring scale used does not extend up to 240 pounds, the moment arm from the c.g. to the mount will be increased to apply the same moment into the mount:

$$M = F \times l$$

$$M = 240 \times 8.6 = 2064 \text{ inch - lbs.}$$

#### **Downward Load of 4 g's**

Downward = 4 g's x 60 pounds = 240 pounds.

The downward load will be applied using weights hung from the test fixture.

#### **Sideward Load of 2 g's**

Sideward = 2 g's x 60 pounds = 120 pounds.

The lateral load will be applied with a spring scale.

#### **Upward Load of 1.5 g's**

The upward load of 1.5 g's is not considered critical.

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## Drag Load

The drag load is calculated as follows:

$$D = \frac{1}{2} \rho V^2 S C_D \quad \text{where:}$$

$D$  = Drag Force in pounds,

$\rho$  = Air Density = 0.002377 slugs/ft<sup>3</sup>

$V$  = Velocity = 130 kts = 220 ft/sec

$S$  = Frontal Area = 1.68 ft<sup>2</sup>

$C_D$  = Drag Coefficient = 1.12 (Ref. Hoerner, Fluid Dynamic Drag, p. 8-3, Fig. 7.)

Drag Force  $D$  = 108 lbs. Using a Factor of Safety of 1.5 gives an ultimate load of 162 lbs.

The forward load of 240 pounds exceeds the drag force of 162 pounds. The FLIR mounting provisions are symmetrical in the fore-aft direction. Therefore, only the forward load of 240 pounds will be applied, based on its value exceeding the drag force.

The installation must withstand the above described loads without any structural failure or permanent deformation.

## POSITIVE MANEUVERING LIMIT LOAD

A Limit load factor of 3.5 g's is to be applied to the mount.

Downward Limit Load = 3.5 g's x 60 lbs = 210 lbs.

A factor of safety of 1.5 is applied to this limit load.

Downward Ultimate Load = 210 x 1.5 = 315 lbs.

This downward maneuvering load of 315 pounds exceeds the downward emergency landing downward load of 240 pounds. Therefore, only the maneuvering ultimate downward load will be applied, based on its value exceeding the emergency landing load.

At the conclusion of the test, all test hardware will be inspected for any evidence of permanent deformation, damage or failure. If none is found, the test will be considered successful.

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## MEASUREMENT OF GROUND CLEARANCE

The FLIR System Installation Drawings 232-13007 and 206-AA-1001 require that the Imager ground clearance must be at least 10.8 inches minimum. The measurement is made while maintaining 86.00 center to center skid separation.

The clearance between the bottom of the FLIR and the ground will be measured with the aircraft off the ground with no load on the skid gear. The aircraft will be lifted with jacks or other provisions so that the skid gear is just off the ground with no weight on the gear.

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PREMIER AVIATION ENGINEERING REPORT NO. E94-309

STATIC TEST OF A BELLY-MOUNTED FLIR ON  
BELL 206 SERIES HELICOPTERS

PART II: TEST RESULTS

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BY:   
Martin R. Crane

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## TEST RESULTS

The static test was carried out on Monday, March 7, 1994. The test witnessing was delegated to DER H.H. Waldrup, who witnessed the test.

### Downward Load

The downward load requirement was 315 pounds. The downward load was applied using lead weights stacked on a load fixture. The actual load applied was 325 pounds. Figure 1 shows the application of the downward load.

### Sideward Load

The sideward load requirement was 120 pounds, applied at the FLIR Imager c.g., 8.6 inches below the FLIR mount. The sideward load was applied with a spring scale at a moment arm of 10.0 inches, equivalent to a side load of 139 pounds. Figure 2 shows the application of the sideward load.

### Forward Load and Drag Load

The forward load requirement was 240 pounds, applied at the c.g. of the FLIR Imager. The drag load was 162 pounds. Only the 240 pound load was applied, as the mount has fore-aft symmetry. The load was applied in the aft direction to facilitate the personnel actually applying the load.

The range of the spring scale used had a limit of 200 pounds. Therefore, the moment arm from the c.g. to the mount was increased to apply the same moment into the mount:

$$\begin{aligned} \text{Requirement} \quad M &= F \times l \\ M &= 240 \times 8.6 = 2064 \text{ inch - lbs.} \end{aligned}$$

A load of 200 pounds was applied at a moment arm of 12.0 inches, or:

$$\begin{aligned} \text{Actual Load} \quad M &= F \times l \\ M &= 200 \times 12.0 = 2400 \text{ inch - lbs.} \end{aligned}$$

This was equivalent to a fore-aft load of 279 pounds. The aft load is not shown in a Figure. The camera used had run low on battery power, and three attempts were made to photograph the ultimate load application, to no avail.

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## STATIC TEST CONCLUSIONS

Upon completion of testing all test hardware was inspected for any evidence of deformation, damage or failure. No deformation, damage or failure was found.

The test results substantiate the FLIR Installation, Belly-Mount, P/N 206-AA-1003-05, installed per Premier Aviation MDL 206-AA-01.

The test is considered successful.

## MEASUREMENT OF GROUND CLEARANCE

The measurement was taken on Tuesday, March 8, 1994. The clearance between the bottom of the FLIR and the ground was measured with the aircraft off the ground with no load on the skid gear. The skid gear spacing was verified as 86 inches, center to center.

The actual FLIR Imager was not available at the time of measurement of the ground clearance. Therefore, the clearance of the fuselage skin to the ground was measured, and the FLIR Imager clearance was calculated, based upon the dimensions available from FLIR Systems Inc. The dimension from the top of the FLIR dove-tail mount to the bottom of the stowed FLIR Imager is approximately 17 inches. The Premier mounting hardware adds an additional 0.25 inches below the fuselage skin to the FLIR dove-tail mount. Therefore, 17.25 inches is subtracted from the fuselage ground clearance to determine the FLIR Imager-ground clearance.

All three mounting locations for the FLIR Imager were measured, as shown in Figure 3. This will help to define the necessity for the skid gear spacers with the 206L Series helicopters. The measurements are listed as follows:

Installation	Fuselage to Ground	FLIR to Ground	Excess Clearance
132-13007-01	28.25	11.0	0.2"
132-13007-03	30.25	13.0	2.2"
132-13007-05	30.0	12.75	1.95"

All three installations on a Bell Model 206L-4 with high skid gear, P/N 206-706-064-XXX, appear to have enough clearance. The -01 installation, (between the fore and aft cross-tubes,) has only 0.2 inches clearance, therefore, a note has been added allowing a 1" Spacer Block as an alternate installation on 206L series helicopters. With the -03 and -05 installations, no spacer is needed on 206L series helicopters with high skid gear, P/N 206-706-064-XXX.

For the Bell Model 206A/206B, with high skid gear, P/N 206-706-031-XXX, an allowance for either a 1" or 2" Spacer Block has been left on the installation drawing.

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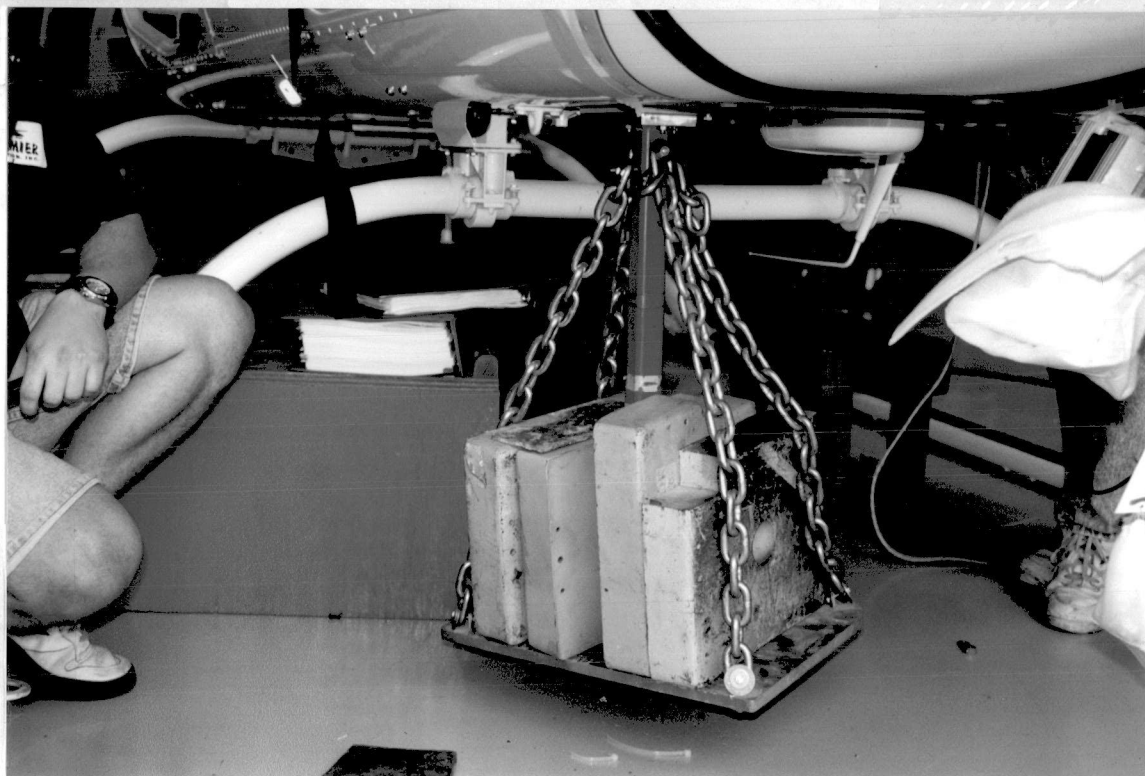


Figure 1. Application of Downward Load of 325 pounds.

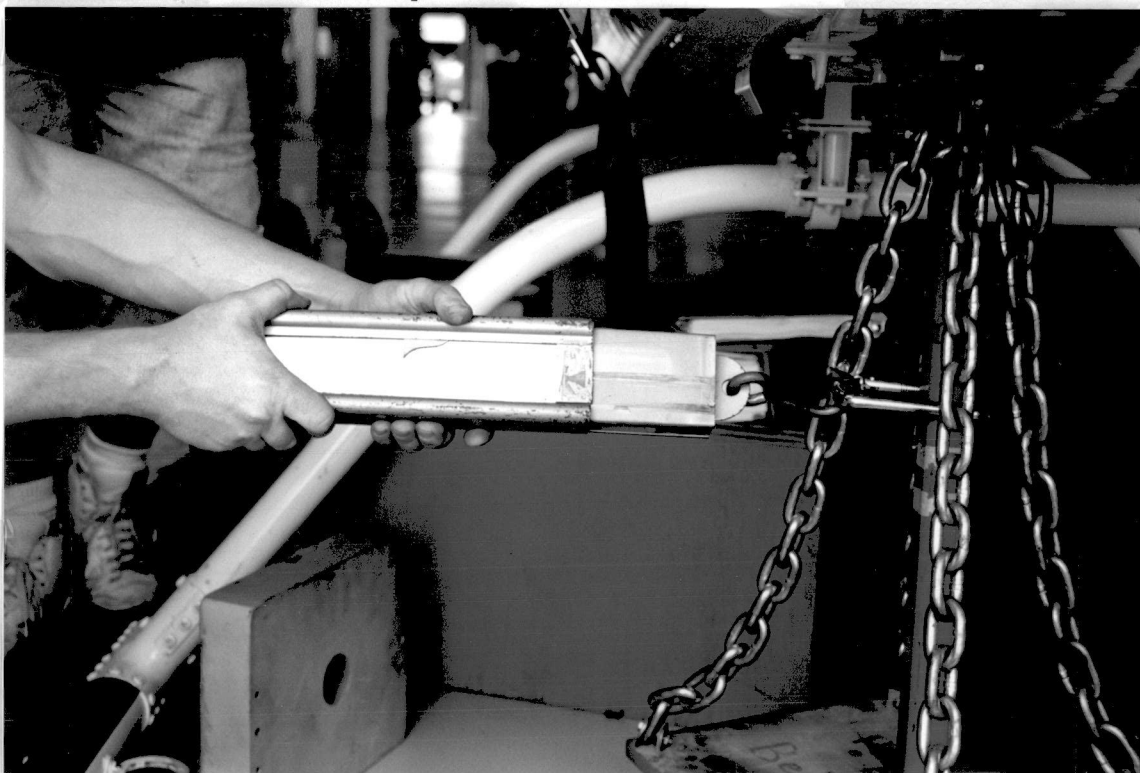


Figure 2. Application of Sideward Load of 120 pounds.

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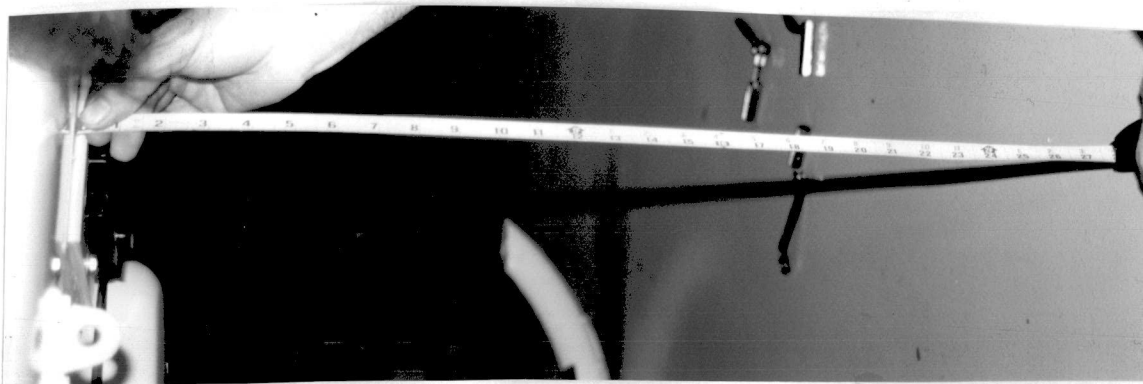
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a. 130-13007-01 Installation



a. 130-13007-03 Installation



c. 130-13007-05 Installation

Figure 3. Measurement of Ground Clearance.

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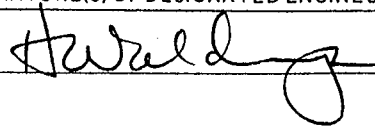
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PA-94-034

94-030		U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION		DATE 11 MAR. 1994	
STATEMENT OF COMPLIANCE WITH THE FEDERAL AVIATION REGULATIONS					
AIRCRAFT OR AIRCRAFT COMPONENT IDENTIFICATION					
MAKE BELL HELICOPTER		MODEL NO. NOTED		TYPE (Airplane, Radio, Helicopter, etc.) HELICOPTER	
				NAME OF APPLICANT PREMIER AVIATION	
LIST OF DATA					
IDENTIFICATION		TITLE			
E94-309 REV A, DATED 3/9/94		REPORT-STATIC TEST OF A BELLY MOUNTED FLIR ON BELL MODEL 206 SERIES HELICOPTER			
		-----END-----			
NOTE 1.		APPROVED FOR 206A, 206B, 206L, 206L-1, 206L-3 AND 206L-4			
PURPOSE OF DATA		WITNESS AND APPROVE STATIC TEST FOR STC REVISION. (REF. SW-170-909)			
APPLICABLE REQUIREMENTS (List specific sections)					
CAR 6.200, 6.201, 6.202, 6.212, 6.260, 6.300, 6.301, 6.302, 6.303, AND 6.304.					
<p><b>CERTIFICATION</b> - Under authority vested by direction of the Administrator and in accordance with conditions and limitations of appointment under Part 183 of the Federal Aviation Regulations, data listed above and on attached sheets numbered _____ have been examined in accordance with established procedures and found to comply with applicable requirements of the Federal Aviation Regulations.</p> <p>I <input checked="" type="checkbox"/> Therefore <input type="checkbox"/> Recommend approval of these data  <input checked="" type="checkbox"/> Approve these data</p>					
SIGNATURE(S) OF DESIGNATED ENGINEERING REPRESENTATIVE(S)		DESIGNATION NUMBERS(S)		CLASSIFICATION(S)	
 H.H. WALDRUP		SW-530		STRUCTURAL	

STC 5H37635W